Energy for the Circular Economy: an overview of Energy from Waste in the UK

environmental services association

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Executive Summary

There are strong signs that the UK Government now recognises both the urgent need for better resource productivity and stewardship, and the exciting opportunities it brings for jobs, innovation, growth and sustainable lifestyles; in short, for what has been known for years now as a more Circular Economy.

Government policies are converging and the 25 Year Environment Plan, the Clean Growth Strategy and the Industrial Strategy including HNIP (BEIS funding for District Heating) all acknowledge the importance of a circular approach to resources.

With the UK all but certain to adopt the EU Circular Economy targets for recycling, the forthcoming Resources & Waste Strategy will provide more clarity on how the Government believes this welcome level of ambition can be achieved and will crucially set out the roadmap for the future direction of the recycling and resource management industry.

What is becoming clear is that the UK is progressively moving towards a sustainable circular economy model similar to Scandinavia. Here recycling is maximised and low-carbon energy recovery technology is used to create electricity and district heating from non-recyclable wastes for local developments and communities.

Despite the recent Government, media and public focus on waste and resources, more attention needs to be devoted to addressing the issue of managing and utilising waste left over after recycling in all its forms. The Environmental Services Association (ESA) has a clear view on residual waste and it is one which complements Government policy support for new private sector investment in UK infrastructure that will improve national productivity and efficiency.

In line with the waste hierarchy, once economically recyclable materials have been collected, Energy from Waste (EfW) remains the best option for treating residual waste. As well as putting waste to further use, thereby upholding the principles of the Circular Economy, it provides sufficient reliable, decentralised, low-carbon electricity to power 1.8m UK homes and could support more low-carbon local heat networks recommended within the Clean Growth Strategy.

There is now an opportunity to further increase economic growth and energy security by bridging the capacity gap for residual waste for which there is no existing or planned treatment infrastructure. **This gap is forecast to be at least 3.5M-6Mt/y in 2030, even with supportive measures for recycling.** This excludes the reshoring of another 2.5Mt/y waste which will continue to be exported at the UK's cost, when it could be treated here and used to create jobs and to power a further 450,000 homes.

Modern advances in EfW plants have also significantly improved performance efficiency and emissions, as well as saving 200kg CO_2e per tonne of waste diverted from landfill. This can be further improved as we recycle more and utilise more heat. All this is achieved whilst keeping waste management costs down for councils and businesses, which is vitally important during a time when budgets are severely constrained.

The reality is urgent action from Government is required via the Resources & Waste Strategy and the impending National Infrastructure Assessment on waste to deliver recycling targets and to ensure that the UK has the necessary domestic treatment infrastructure to handle post-recycling waste, as landfill capacity continues to rapidly diminish.

This is a call for Government to act now to prevent the lost opportunity of up to 60 million tonnes of waste being buried in the next 10 years. Our sector, in cost-effective partnerships with local authorities, is already successfully generating clean, low-carbon energy from non-recyclable waste at world-class facilities across the UK. With Government support this could be a real UK plc power and growth success story.

ESA estimates that, with the right policy support, up to £10bn of private sector capital will be unleashed across the sector, delivering 50,000 jobs, boosting GDP by £3bn each year and contributing to economic growth.

This report provides an overview of EfW and its current vital role in a more circular economy, and looks forward to where the sector is heading. In essence ESA is not asking for funding or complex policy measures for EfW. Rather, ESA firmly believes Government can help to unlock domestic infrastructure investment in EfW by creating a coherent, stable policy environment for recycling and resource management that recognises our sector's positive role in delivering even greater benefits to the economy, whilst supporting and delivering the UK's recycling ambitions.

Source: Viridor

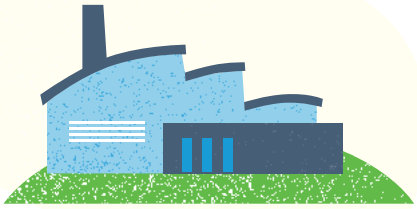
The UK still sends over **12m tonnes** of household and commercial waste to landfill

Without action, there will be **8.5m tonnes** of non-recyclable waste without a home in 2030 as we move away from landfill

Energy from Waste converts non-recyclable waste into **heat and power**, and recycles the ash in roads and other construction projects

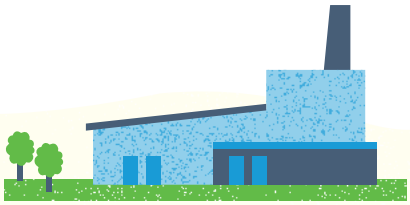
Each tonne diverted from landfill to Energy from Waste saves **200kg of CO_2**...

...and generates enough electricity to make **22,000** cups of tea



Public Health England has said modern Energy from Waste plants do not pose a significant risk to public health and make only a **small contribution** to air pollution

Energy from Waste **complements high recycling**. Germany, Belgium, the Netherlands, Switzerland and Austria all recycle more than 50% of their waste and recover energy from the rest



Even with higher recycling we may still need up to an additional **6m tonnes** of Energy from Waste capacity

This would generate power for an **extra 1m homes**, the equivalent to an area the size of Birmingham

Summary of recommendations

1. **POLICY: Develop an ambitious and robust Resources & Waste Strategy and establish a plan for high quality recycling**
   Defra's forthcoming Resources & Waste Strategy must not only set long-term ambition levels for greater resource productivity, it must put in place comprehensive policies to deliver the outcomes it wants to see; including a clear plan for waste reduction and recycling that will improve the quality of recycled material and stimulate demand.

2. **SOLUTIONS: Address the residual waste capacity gap and provide long-term regulatory certainty**
   Once waste reduction and recycling priorities have been set, the Government should work with industry to assess how much extra residual waste treatment capacity is needed and to enable its delivery. Delivery should not be undermined by sudden changes to taxes and subsidies, any such changes should be signalled well in advance. To this end BEIS & Ofgem should set out a stable charging regime for electricity networks that will enable the transition to more low-carbon infrastructure.

3. **ENABLERS: Enable CHP plants to help address the energy gap and ensure the planning and permitting regime does not unfairly disadvantage EfW**
   A heat sector plan should be developed and Local Authorities should strengthen sustainability criteria in local plans, for example with low-carbon heat targets, to encourage greater use of combined heat and power. The Government should also enforce the determination period in the local planning process to ensure projects can be delivered on time and for the best value. Permits issued by the regulator should be fit for purpose and enforced.

1.

Introduction

The management of waste and resources in the UK has undergone a significant transformation over the past two decades and represents a sustainability success story. Materials at the end of their lives used to be seen as a problem we called 'waste' which was best buried out of sight. Now, however, many waste materials are seen as a 'resource' presenting an opportunity to be given new life by being put to another use. Alongside an eightfold increase in recycling, EfW has been at the forefront of the transformation from waste management to resource management.

Where the default option used to be to send everything to landfill, there is now a sophisticated range of resource management solutions designed to extract the most value from individual waste streams. Each of these options plays a vital part, and therefore we need to think about them in parallel and develop policies accordingly.

Unfortunately the policy drivers in the UK at the moment do not take such a holistic approach. There are positive signs that the Government has appetite to take action, and this could not come a moment too soon. Without further policy action, we are heading towards a situation where we look likely to miss our EU recycling targets, whilst failing to put in place the treatment infrastructure necessary to deal with non-recyclable waste. With current recycling rates stagnating at around 45%, we seem unlikely to meet the current target of 50% by 2020.

The industry estimates that under the current policy regime we may only achieve around 55% municipal recycling by 2030, which will potentially leave us 5% shy of the EU 2030 target. This would also result in a residual waste treatment capacity gap of around 8.5 million tonnes—an improvement on the current shortfall of over 12Mt, but a major shortage nonetheless. Even if the UK were to achieve 65% recycling, there would still be a risk of under-capacity for residual waste treatment in the UK.

It is essential then that the UK Government provides clarity on future recycling targets, supported by robust actions to achieve them. This must include strengthening end markets to ensure there will be enough demand for recycled materials. The Government in collaboration with the industry must then decide what to do with the remaining post-recyclable waste, known as residual waste.

The most common option for dealing with this left-over waste is to recover energy via combustion in what are known as Energy from Waste facilities.

EfW is currently the most sustainable option for dealing with our combustible residual waste, after economically recyclable materials have been collected. It helps to reduce our carbon footprint and contributes to the UK's energy mix and energy security, providing reliable, decentralised, low-carbon electricity and heat to millions of businesses and homes around the country. The regulatory framework alongside technological advances has also significantly improved efficiency and reduced emissions. Furthermore, EfW keeps waste management costs down for councils, which is increasingly important at a time when local authority budgets are tightened.

The waste hierarchy helps illustrate the role of EfW; separating recyclable materials for recycling and reprocessing should be prioritised over energy recovery where there are markets for those materials, but energy recovery is clearly preferred over landfill for non-recyclable, combustible material. To manage all the UK's waste effectively, all levels in the waste hierarchy need to be addressed.

EfW already delivers environmental and economic benefits to the UK whilst keeping costs down for local authorities. However, it could make an even stronger contribution. Currently we spend £280m to export approximately 3.5Mt of waste (refuse derived fuels) a year for other countries to generate energy for their own benefit, whilst at the same time importing electricity. Instead, this waste could be reshored to power an additional 620,000 homes here in the UK.

Alongside a robust recycling strategy, therefore, a clear, supportive policy approach is needed to encourage private sector investment in EfW infrastructure in order to address current and future shortfalls in the necessary treatment capacity.

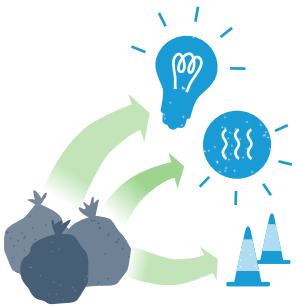
As the trade association representing the UK's waste and secondary resource industry, the Environmental Services Association (ESA) turns waste into valuable resources whilst protecting the environment. We represent approximately half of the sector—including all the major companies—speaking on their behalf in the UK and the EU. We help raise industry standards and lobby constructively for a policy framework which enables ESA Members to operate responsibly, delivering sustainable resource management for the benefit of the environment.

In 2016, our members, who represent 97% of EfW capacity, diverted 9.6Mt of waste from landfill to EfW and produced 5TWh of low-carbon electricity. Many of ESA's EfW operators also offer a wide range of waste management services and solutions. This includes running collections, managing Household Recycling and Reuse Centres, and operating sorting facilities, recycling plants, organic treatment facilities such as Anaerobic Digestion and composting, and landfills. This uniquely allows them to take an integrated waste management approach that puts each waste stream to the best use for the benefit of the environment and the economy.

2.
Where are we now?

Existing plants

There are 40 municipal Energy from Waste plants in the UK, of which 8 export heat, and there are 9 more in construction. ESA members run 37 of the operational plants. In addition there are a number of specialist facilities that process hazardous waste, clinical waste, animal by-products and sewage sludge.



— 10Mt of municipal waste was diverted from landfill to EfW in the UK in 2016. [1]

Capacity

We have around 13Mt/y of residual waste treatment under-capacity in the UK, based on current arisings and current operational capacity. Landfills are closing more rapidly than was anticipated, but the alternative residual waste infrastructure (largely EfW plants) is not coming on stream quick enough to replace them. In 2017, ESA commissioned Tolvik Consulting to assess the UK's EfW capacity going forward. The report drew on a number of analyses and estimated that if recycling rates do not significantly improve, there will be 8.5Mt of residual waste with no home by 2030, leaving the UK vulnerable to increased waste crime, and forcing us to open more landfills. Even if we can achieve higher recycling rates, there is still a risk of under-capacity of up to 6Mt per annum. [2]

To deal with this gap in the short-term, we are paying to send 3.5Mt of residual waste to overseas EfW plants to recover energy for their benefit, whilst at the same time we are importing electricity. This makes little sense in the long-term when there is a huge opportunity to recover that energy domestically. This will make the UK's energy supply more secure, boost UK plc, save money for local authorities, householders and businesses by reducing both waste management costs and energy bills, and create high-skilled green jobs around the country.

> **It makes no sense to me that we are creating refuse derived fuel, paying for it to be exported and buying the energy back. We should be using it to generate energy here.**
>
> *Professor Margaret Bates, University of Northampton, and President of CIWM*

1 Tolvik Consulting, *Energy from Waste Statistics – 2016* (2017) p.4
2 Tolvik Consulting, *UK Residual Waste: 2030 Market Review* (2017)

3.
Where are we going?

We are now at a cross-roads. The current fleet of EfW facilities was built using public-private partnerships to meet EU landfill diversion targets, which we have comfortably met. However, since Government withdrew PFI funding support in 2013, future capital investment has been left to the private sector with no supportive policy framework to help.

Recycling

The EU Circular Economy Package has set municipal recycling targets of 60% for 2030, rising to 65% for 2035. The UK has indicated that it will adopt the Circular Economy Package in its entirety, including the targets. In its current form, ESA believes the Circular Economy Package by itself is not strong enough to deliver the recycling rates it sets out to achieve. More must be done to stimulate demand for recycled material.

Recent communication and activity from the Government is demonstrating clear signs of progressive leadership. The Government has published its 25 Year Plan for the Environment which sets the admirable ambitions of zero avoidable waste by 2050 and zero plastic waste by 2042. It is also consulting on establishing a Deposit Return Scheme for plastic bottles, introducing taxes or charges to reduce single-use plastic, and banning plastic straws. The National Infrastructure Commission (NIC) is addressing the pressing need for waste infrastructure across the UK. And recent signals from Defra imply that the Resources & Waste Strategy due towards the end of 2018 will be more ambitious than was initially expected.

This is all very encouraging. However, a clear driver for the Government's recent actions has been the rightful public outrage over plastics ending up in the ocean and the wider environment as a result of littering and lack of developed waste management infrastructure and practice in many countries. This is an incredibly important issue, and it is right that the Government is taking action. But if it is serious about resource efficiency, productivity, and delivering a more circular economy, then action must go beyond tackling plastics and littering, and address all waste materials, and all unsustainable consumption. In short, without taking a holistic, integrated approach to waste management, isolated actions to tackle relatively small but high-profile waste streams will do little to increase overall recycling and improve resource efficiency.

If things continue as they are, the industry believes municipal (household and commercial & industrial) recycling levels of around 55% are realistically achievable by 2030, which would mean we lag at least 5% behind our European colleagues should they meet their targets. This will result in more residual waste that will require treatment capacity.

Landfill

Landfills are currently closing far more rapidly than alternative infrastructure is coming on stream to treat the diverted waste. Landfill capacity is expected to expire by 2023,[3] though some replacement landfills will have to open in that time to continue to manage specialist waste, residues and other non-combustible waste. At a local level, many counties already have no landfill capacity, particularly in the South East.

3 Based on Environment Agency, *Waste Management 2016 in England: summary*

RDF exports

As a result of landfills closing and a lack of domestic EfWs, we are exporting large quantities of waste as fuel to other EU countries. Current RDF (refuse derived fuel) exports from UK are estimated at 3.5Mt.[4] This is at a cost to the UK. Indeed, we are spending approximately £280m a year to export waste for other countries to generate energy for their own benefit.[5] These costs have only increased due to foreign exchange rate impacts following the Brexit referendum. Not only are we wasting the opportunity to use this fuel as a resource domestically if we built additional capacity, it is also thought that the European spare capacity is near saturation.

Capacity

Altogether we are currently burying and exporting around 16Mt of waste that could be used domestically as a fuel. As the current pipeline of EfW plants come on stream, that figure is set to drop to between 6-11Mt by 2030. That represents 3,300-6,000GWh of lost UK electricity and £500m-£930m in landfill tax payments. Even if we were to achieve more ambitious recycling rates of 65%, we would still be sending around 2.5Mt of waste overseas as fuel which could be treated domestically.

Landfill closures, combined with long lead-in times of 4-6 years for new treatment facilities, mean that some regions are already experiencing a shortfall. Increasing regional imbalances will mean that waste will have to travel further (predominantly from South to North),[6] which raises costs, potentially increases emissions due to extra road haulage, and opens up greater opportunities for waste crime.

If the UK fails to build more EfW, the only option for this waste will be to develop even more replacement landfill capacity than it will already need for non-recyclable, non-combustible waste. This would be a backwards step both environmentally and economically. It is therefore vitally important that we continue to plan for residual waste treatment, including building up the appropriate EfW capacity.

Brexit

All this is taking place at a time of great uncertainty within the UK. The EU has thus far provided a policy framework for waste and resources. Though this has not been without criticism, it has set a long-term direction of travel which has enabled investment. The danger is that once we have left the EU, that framework will be dismantled without anything being developed in its place.

On the other hand, this presents an excellent opportunity for the UK to develop its own, bespoke waste and resources strategy, better suited to our own domestic circumstances and resource needs. ESA has been working hard with Government policy makers since the Brexit vote to help shape this new UK policy landscape. The 25 Year Environment Plan is a good start and echoes much of what ESA have been calling for but it is vital that its ambition is matched with meaningful detail, commitments and actions in the forthcoming Resources & Waste Strategy.

We need a UK roadmap

EfW plants rely on clear and stable long-term policy and regulation to be delivered. The UK recycling and resource management industry has for a long time been calling for a coherent strategy for waste and resources in the UK, and this is all the more important as we prepare for Brexit. EfW policy must be a fundamental part of this strategy.

4 Estimate based on Environment Agency, *Reasons for trends in English refuse derived fuel exports since 2010* (2015)
5 Policy Exchange. *Going Round in Circles: Developing a new approach to waste policy following Brexit* (2017), p.29
6 Suez, *Mind the Gap 2017-2030: UK residual waste infrastructure requirements* (2017)

4.
How do we get there?

It is vital that EfW attracts investment, and that is only possible with a long-term, coherent policy strategy, which boosts investor confidence and combats some of the negative and misguided commentary around EfW that unfortunately we still see.

ESA is not asking for funding or complex policy measures; financial support and policy interventions should be targeted at stimulating high quality recycling. Rather, we want the Government to unlock investment in EfW by creating a coherent, stable policy environment for resources and waste management that recognises the positive role of EfW in supporting the other levels of the waste hierarchy.

Recommendations

1. POLICY

Develop an ambitious and robust Resources & Waste Strategy and establish a plan for high quality recycling

Defra is currently working on a Resources & Waste Strategy as a part of its 25 Year Environment Plan, which is a welcome move. This Strategy must not only set ambition levels, but put in place the right policies to deliver the outcomes it wants to see. ESA urges Defra to work with its Government colleagues in BEIS, NIC, DCLG, and HM Treasury to ensure there is a joined-up approach.

- The ESA believes that the new Strategy must have at its heart high quality recycling as a priority and contain confirmed recycling targets and metrics, along with a robust plan explaining how they will be met. The Strategy also needs to drive greater use of secondary materials in products and packaging, along with easier to recycle products and packaging that create strong end markets.
- The ESA believes that the identification of solid waste as a priority for the National Infrastructure Commission represents a good opportunity to provide action to deliver the recycling capacity and the EfW plants that the UK needs.
- The ESA would also like to see the Industrial Strategy and accompanying Sector Deals recognise EfW as a crucial way of delivering resource efficiency in the UK, alongside reuse, repair and recycling measures.
- The ESA believes that it is important that the Packaging Producer Responsibility (PRN) regime is modernised so that it properly funds investment in the collection, recycling and treatment infrastructure needed for a truly circular economy
- The ESA believes that a carefully targeted new levy on single use items and possible future deposit return schemes should be designed to function seamlessly with a revised PRN regime in order to prevent unwanted outcomes that may lead to waste being disposed of inappropriately.
- The ESA also recommends a number of measures that it believes would help stimulate the demand for secondary resources and make recycling truly sustainable. These include reforming Producer Responsibility and introducing Extended Producer Responsibility to some new products, leveraging green public procurement, lowering VAT for products with recycled content and introducing eco-design rules that favour recycled materials.

2. SOLUTIONS

Address the residual waste capacity gap and provide long-term regulatory certainty

Once realistic reduction and recycling ambitions have been set, the Government must assess forecasts for residual waste arisings in collaboration with industry. Even with supportive measures for recycling, industry estimates there to be between 3.5 to 6Mt of excess residual waste without existing or planned treatment capacity to deal with it in 2030.

- The ESA believes the Government must send out positive signals that strengthen investor confidence in order to ensure the private sector can deliver the timely infrastructure so desperately needed to boost the UK economy and prevent a return to landfill.
- The ESA would welcome longer term certainty for the landfill tax from HM Treasury and all tax (and subsidy) changes should be signalled well in advance to help underpin long term investment decisions and investor confidence in future infrastructure projects.
- The ESA calls for an end to the instability created by sudden changes in policy direction, for example the removal of the climate change levy and the decision to reduce embedded benefits. Investor confidence would be improved if BEIS and the regulator set out a long term stable charging regime for electricity and heat networks, and provided forward visibility on intentions for renewable energy support.

3. ENABLERS

Enable CHP plants to help address the energy gap and ensure the planning and permitting regime does not unfairly disadvantage EfW

The formulation and implementation of a heat sector plan (with help from the Association of Decentralised Energy - ADE) would enable better utilisation of heat from EfW and prevent missed opportunities to maximise the heat off-take which requires additional infrastructure such as a local heat pipe network. Currently planning is too uncoordinated to ensure end-users (e.g. industry and local communities) are located in the right place to benefit from the heat off-take, and severe planning issues beset EfW.

- The ESA believes heat mapping should be integrated into the planning process to help match up heat providers and heat users and that local authorities should adopt more robust sustainability criteria in their local plans; for example low-carbon heat targets, which would encourage greater use of heat that would otherwise be wasted. This would not only help meet national renewable heat targets, but would save money on energy bills.
- The ESA recognises the success of the Heat Networks Investment Project (HNIP) and believes it should be consolidated by making more funding (than the £320m already set aside) available for investment in new heat networks.
- The ESA is concerned that EfW currently experiences severe planning issues which unnecessarily delay projects and incur debilitating costs. The ESA believes that the absence of a clear policy and position on the role of EfW in a circular economy from Government has led to confusion and that often planning decisions are called-in without good reason which has resulted in a stop-start approach to delivery that increases costs.
- ESA urges the Government to enforce the determination period that local planning authorities have to comply with in order to stabilise the planning process and therefore provide better value to customers. It is also essential that there is a clear and pragmatic approach to environmental permitting, ensuring that permits are fit for purpose and are enforced. This provides assurance to operators, communities and other stakeholders alike.

> **Urgent action from Government is required to deliver ambitious recycling targets whilst ensuring the UK has the necessary domestic treatment infrastructure to handle post-recycling waste, as landfill capacity continues to diminish. With the right policy support ESA estimates that up to £10bn of private sector capital will be unleashed across the sector, delivering 50,000 jobs, boosting GDP by £3bn each year and contributing to economic growth.**

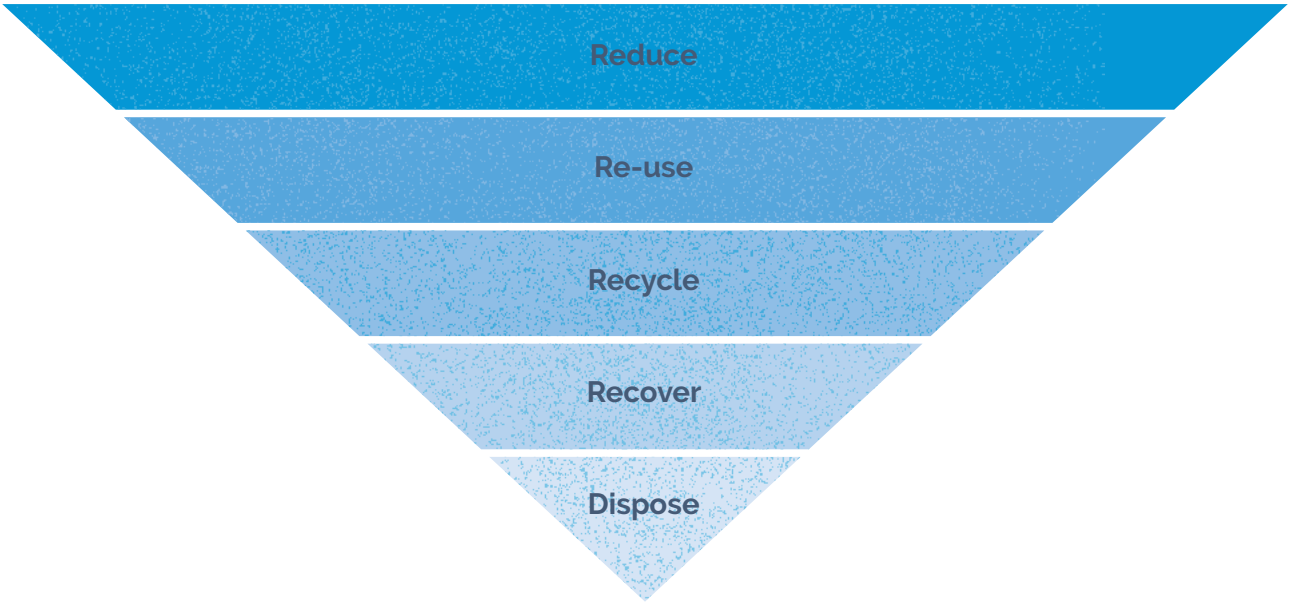
5.
EfW in a Circular Economy

The Circular Economy

The Circular Economy reconfigures our modern-day patterns of consumption from a linear take-make-dispose model, to a more sustainable cycle in which resources are repurposed at the end of their life for continued use in the economy, reducing our reliance on virgin raw materials.

The different options for managing waste at the end of its life are ordered by environmental impact in what is known as the waste hierarchy, which is enshrined in EU and UK law.

After waste reduction and re-use, recycling is the priority for waste management. Though there is still a long way to go, the UK has made significant progress on increasing recycling since the 1990s, when household recycling was at near-zero, to around 45% today.



The reality of residual waste

However, we are still producing around 27 million tonnes of municipal waste annually after recycling,[7] known as residual waste, and similar levels of commercial and industrial waste. This may decrease over time as we develop measures to reduce waste in the first place and then achieve higher recycling rates, e.g. by designing products which are more easily recycled, developing new technology for sorting and reprocessing, and strengthening end markets for recycled material. However, even if waste generation per capita decreases, most forecasts predict a slight increase in overall waste arisings by 2030 due to expected population growth.

Moreover, there will always be some residual waste for a number of reasons:

- some materials are not recyclable for technical or economic reasons
- many materials cannot be infinitely recycled
- some waste is too heavily contaminated
- even after recycling there are residues that need to be disposed of

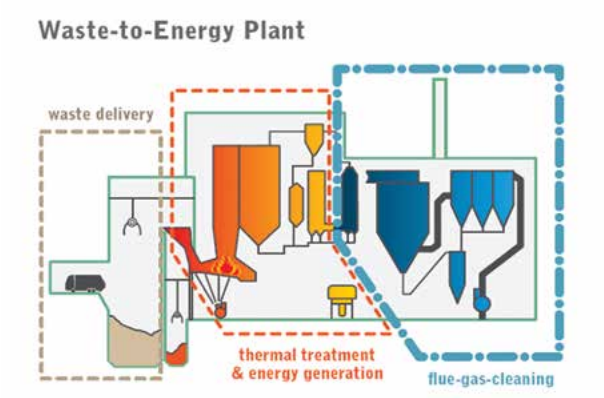
7 Tolvik Consulting, *UK Residual Waste: 2030 Market Review* (2017), p.2

Where high quality recycling is not possible, we need options for treating residual waste according to the principles of the Circular Economy and waste hierarchy, i.e. putting waste to best use by improving energy security and contributing to economic growth.

Energy from Waste as part of the Circular Economy

The next rung on the waste hierarchy below recycling is energy recovery. EfW is the main method for recovering energy from non-recyclable waste, complementing Anaerobic Digestion (AD) for organic waste and less-established Advanced Thermal Treatment (ATT) technologies which usually take pre-sorted feedstock. EfW takes what is left of the waste stream after recycling and recovers energy from it through combustion.

Energy recovery is the preferred treatment for residual waste because overall carbon emissions are significantly lower than landfill, it generates a reliable source of low-carbon electricity, and, where possible, supplies heat via local district heating networks.



Source: CEWEP

Case study

Coventry & Solihull Waste Disposal Company

Coventry & Solihull Waste Disposal Company (CSWDC) is an independent waste management company. The main part of the business is extracting heat and electrical power from municipal and commercial solid waste. The company processes in excess of 290,000 tonnes per year of non-recyclable waste from the local area that would have been sent to landfill, producing 108GWh of power a year which is enough to supply energy to 23,500 houses. The business also provides low-carbon heat for Coventry City Council buildings, Herbert Art Gallery, Coventry Cathedral, and Coventry Sports & Leisure Centre via 6.6km of underground pipes. This not only helps decarbonise heat, one of the urgent challenges facing the energy sector, but ensures the maximum use and value is extracted from the waste.

Source: CSWDC

Case Study

Runcorn

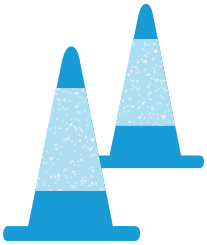
The Runcorn Energy from Waste facility is designed to use pre-treated waste as a fuel to generate electricity and heat for use at the adjacent INOVYN chemical manufacturing site. As one of the largest and most efficient of its kind in Europe, Runcorn EfW diverts 850,000 tonnes of waste away from landfill to produce up to 70MW of electricity and 51MW of heat. This has resulted in a 20% reduction in the amount of fossil fuel-based energy used by INOVYN, helping to decarbonise the UK's energy and boost energy security whilst reducing costs for this important local and regional employer.


Source: Viridor

Circular Economy in action

Recovering energy from waste that cannot be recycled upholds the core principle of the Circular Economy of putting waste to further use and thereby replacing virgin fossil fuels. On top of this, the residues from the process known as Incinerator Bottom Ash (IBA) can be recycled into aggregates for construction, and metals can be recovered and sent for recycling.

Almost all IBA is recycled. ESA has worked with the Environment Agency to develop a protocol for assessing IBA which helps determine whether or not it can be recycled.[8] It sets out a reliable method for assessing the risk of harm to human health or pollution of the environment, and gives IBA customers a high level of confidence in the products they buy.



In 2016:

- 190,000 tonnes of metal was recycled from IBA from EfWs in the UK
- 2Mt of virgin construction aggregate was replaced by recycled IBA[9]

Recycled metals from IBA are now counted in the UK's household recycling rates since they originate from municipal waste and are fully recycled in the same way as metals placed in the recycling bin.

However, recycled IBA is not counted in recycling targets. Since again the origin is household waste which is fully recycled, it follows that IBA that is used to replace virgin aggregate in construction should also be included. Many resources and waste management professionals believe this would be an appropriate way to acknowledge the contribution of recycled IBA to resource efficiency. Indeed, Wales already includes IBA in its reported national household recycling rate.

> **Recycled IBA is not included in the proposed EU municipal waste recycling definition, despite originating from household waste. IBA Aggregate makes an important environmental and economic contribution in replacing virgin raw materials in construction projects, and England should explore ways in which this could be recognised.**
>
> *David Greenfield, Chair of the Institution of Civil Engineers Resource Management Panel*

If recycled IBA was included in these figures across the board, it would boost the UK's recycling rate by around 5%. [10]

8 http://www.esauk.org/esa_reports/20180130_%20IBA_%20Protocol_revised_-_Jan_2018_version.pdf
9 Based on Tolvik Consulting, *UK Energy from Waste Statistics - 2016* (2017), p.8
10 Tolvik Consulting, *UK Energy from Waste Statistics - 2015* (2016), p.10

Case Study

Ballast Phoenix Limited

Ballast Phoenix Limited (BPL) processes IBA to create a sustainable source of aggregate (IBAA) for use in many construction applications. As a result of BPL's processing and aggregate expertise, all the IBA is diverted from landfill. BPL's IBAA was the optimal choice for construction company Skanska to use on the Catthorpe Interchange on the M6 and M1. The IBAA's strength characteristics were so consistently good it was decided by Skanska that the pavement foundation thickness could be considerably reduced. Furthermore, the lower density of the IBAA proved to have a substantial cost saving due to fewer traffic movements and lower tonnages required.

Case Study

Scanmetals UK Ltd

ESA Member Scanmetals' plant in Wolverhampton takes the non-ferrous metals from UK EfW plants and sorts them into aluminium, copper, brass and many other metals streams, so they can be used again in manufacturing in high value applications. Using advanced technology, it breaks down each of these metals streams into a range of size fractions, because different size fractions are better suited to different manufacturing applications, in order to maximise the value of what's recovered.

None of this would be possible if they hadn't already been through the EfW process, where the non-metallic attachments burn off. The larger aluminium pieces, for example, are sent to a smelter in Coventry, where they are alloyed into ingots with very precise specifications, and then used in cars and engines across major manufacturing facilities in the UK. With this recycling chain in place, metals from the residual waste stream can end up in the highest value and most demanding applications.

Source: Scanmetals

EfW coexists with high recycling

Many of the countries with exemplary recycling rates also have relatively high energy recovery rates. Germany has the highest recycling rate in the world at 66% and incinerates 32% of its waste. Austria recycles 58% of its waste and incinerates 38%. The Netherlands, Switzerland and Belgium all have recycling rates of 53%, with incineration rates of 46%, 48% and 45% respectively.[11] This is because the energy recovery process has diverted non-recyclable waste from landfill rather than diverting recyclable waste from recycling.

Some stakeholders are concerned that the UK could build too much EfW which would then require more feedstock and compete with recycling, citing current over-capacity of EfW in Northern Europe. This situation is something the UK has avoided, with a current under-capacity of EfW expected to continue for years to come. Indeed, most forecasts show a persistent under-capacity remaining long term.

With reliance now on private rather than public sector funding for future EfW delivery in the UK, supply and demand dynamics will help prevent over-capacity happening. Investment interest will decline as the market becomes more developed, i.e. as remaining 'available' residual waste volumes shrink. Similarly, the fears of inflexible, long term (25+ years) local authority contracts tying in waste volumes are of little relevance going forwards. Current examples, e.g. in Dunbar,[12] show that local authorities now prefer shorter (7-10 years), more flexible, 'fuel supply', gate fee based contracts, similar to the approach by commercial waste producers.

The context here in the UK is therefore very different to that in countries experiencing over-capacity. Indeed, an EU Communication on Waste to Energy (2017) urged caution in developing publicly-funded EfW plants (as happens elsewhere in Europe) but reinforced the view that EfW has a role to play in the transition to a circular economy. [13]

Furthermore, EfW plants play an active role in promoting recycling. In the UK, most facilities have education centres that engage members of the public and school pupils who can learn outside the classroom about what happens to their waste, and how they can reduce, re-use and recycle. EfW and recycling can and do co-exist successfully right across Europe.

Case study

Cornwall Energy Recovery Centre

At the Cornwall Energy Recovery Centre (CERC), SUEZ aims to provide a high quality educational experience that inspires curiosity and fascination about waste management strategies, both in Cornwall and the wider world.

Source: Suez

In Cornwall, the dedicated Community Liaison Manager and Education and Community officers welcome a range of visitors to the CERC, from Primary and Secondary school pupils to Rainbow and Cub Scout groups, as well as Rotary and local interest clubs. Visits to the CERC often include a tour of the plant and make use of the bespoke, state-of-the-art visitor centre experience. Each visit is tailored to the group's needs and, for school groups, they ensure that the experience provides an extension to the learning that has taken place in the classroom.

Environmental awareness is high on the team's agenda. They are committed to helping the local community understand more about the ways their waste is managed and the new technologies which provide a sustainable alternative to landfill.

Since the facility opened in March 2017 it has welcomed over 800 visitors to the facility, with very positive feedback.

11 Eurostat
12 https://waste-management-world.com/a/127m-waste-to-energy-feedstock-contract-for-viridor-in-scotland
13 http://ec.europa.eu/environment/waste/waste-to-energy.pdf

Case Study

Lincolnshire Energy from Waste Visitor Centre and Community Liaison Group

Free of charge visits for schools, business and community groups, Community Liaison Groups, and open day events all play a vital role in providing a better understanding of good waste management. The FCC-operated Lincolnshire EfW plant provides funding for transport to Lincolnshire's schools to give them the best opportunity to bring students of all ages and experience first-hand where their non-recyclable waste goes and explain how it is used to generate valuable resources like electricity. The education pack for schools and the presentations delivered to the adult groups also cover information about good recycling and composting. The setup of the visitor centre provides a safe and secure learning environment, accommodating all levels of learning ability and requirements.

The facility has a Waste Free Lunch Challenge to encourage ideas about how to reduce the waste you make where the students are asked to bring the least amount of waste in their packed lunch. The school with the least amount will win a certificate to proudly display at their school.

During these visits, groups discuss how landfill is a major contributor to problems like global warming and climate change and the reasons why recycling and alternative waste treatments, like EfW, are essential for a sustainable future. It is an opportunity to provide accurate information with regard to air quality; the facility operates under the 2010 Industrial Emissions Directive standards and does not pose a health risk to people living near the plant. This provides a better understanding and reassurance, and builds trust and good relationships within the area.

Over the last 3 years the visitor centre has seen thousands of visitors from all walks of life and the feedback has been 99.9% positive.

Source: FCC

6.
EfW in a low-carbon economy

Mitigating Climate Change

Climate change is one of the biggest challenges facing us today and for future generations. Under the Climate Change Act 2008, the UK has an obligation to reduce its greenhouse gas emissions by 80% by 2050 against a 1990 baseline. In conjunction with this, the UK has a target to generate 15% of its energy from renewable sources by 2020, however a report from the House of Commons Energy and Climate Change Select Committee concluded that these targets are likely to be missed.[14]

> **The UK has a legally-binding target of achieving 15% of its total energy (electricity, heat and transport fuel) from renewables by 2020. EfW has a significant role in all of these energy sectors.**
>
> *The Renewable Energy Association* [15]

EfW has many climate benefits over landfill. Though modern landfills capture the methane emitted from the sites and use it to generate renewable energy, EfW can generate energy far more efficiently. Not only is the energy produced part-renewable due to more than 50% biogenic (organic) content in municipal waste, it also avoids the emissions associated with extracting virgin fossil fuels. Since there is a net carbon saving of approximately 200kg of CO_2e per tonne of residual waste diverted from landfill to EfW,[16] EfW can help in the fight against climate change.

Key stats

- EfW saves 200kg of CO_2e per tonne of waste diverted from landfill
- In 2016, the waste used to fuel EfW was equivalent to replacing 2.5m tonnes of virgin fossil fuel oil [17]

> **[EfW can] contribute to our battle against climate change and help meet our needs for affordability and security of energy supplies.**
>
> *Institution of Mechanical Engineers* [18]

> **Compared to landfilling, waste incineration and other thermal processes avoid most GHG generation, resulting only in minor emissions of CO_2 from fossil C [carbon] sources.**
>
> *The Intergovernmental Panel on Climate Change (IPCC)* [19]

14 Energy and Climate Change Committee, *2020 renewable heat and transport targets* (2016)
15 https://www.r-e-a.net/pdf/member/10_EnergyFromWasteGuideForDecision-Makers.pdf
16 Green Investment Bank, *The UK residual waste market* (2014), p.9
17 Digest of UK Energy Statistics (DUKES, 2017), p.190
18 Institution of Mechanical Engineers, *Energy from Waste: A Wasted Opportunity?* (2008)
19 http://www.ipcc.ch/pdf/assessment-report/ar4/wg3/ar4-wg3-chapter10.pdf

Generating renewable electricity

Since over 50% of the fuel is biogenic, EfW contributes to the UK's renewable energy targets.

- EfW generated 2,741GWh of renewable electricity in 2016, 3.3% of the UK's total renewable electricity generation [20]

Powering and heating homes and businesses

The steam that is produced in the EfW process is used to power turbines which generate electricity for local use or for export to the National Grid. Hot water and steam can also be exported for local heat use.

- In 2016, it provided 1.6% of the UK's total electricity, the same amount as hydro generation
- This was enough electricity to power the equivalent of 1.8 million homes [21]
- 730GWh of heat was supplied to district heating networks and industrial users, and there is potential for much more heat utilisation [22]

> **EfW can make an important contribution to increasing the efficiency of our power system and play a vital role in helping us achieve our heat decarbonisation targets. It is extremely important that heat not captured from plants can be supplied to local communities through heat networks and we strongly welcome a focus on increasing the use of EfW CHP to meet local heat demand.**
>
> *Dr Tim Rotheray, Director at The Association for Decentralised Energy*

Contributing to energy security

EfW is a relatively stable domestic fuel source. It provides a reliable source of baseload power which complements intermittent renewables, helping to diversify the UK energy mix as we transition to a low-carbon energy system. It is also not reliant on imports and fossil fuel price fluctuations unlike some other forms of power generation, and saves money by reducing landfill tax costs. This is a truly circular solution, with society's residues being used to power industry, cities and homes, which is far better than exporting residues to Europe to be burned and importing energy for use here in the UK.

20 Digest of UK Energy Statistics (DUKES, 2017), p.188
21 Digest of UK Energy Statistics (DUKES, 2017), p.188
22 Tolvik Consulting, *Energy from Waste Statistics – 2016* (2017) p.6

Case Study

Riverside

The Riverside EfW facility in the London Borough of Bexley, operated by Cory Riverside Energy (Cory), is not only the largest in the UK, but also one of the most efficient, being the first EfW facility in London to achieve the coveted R1 recovery status. In 2016, the Riverside facility generated 528GWh of baseload electricity; enough energy to power 160,000 homes and generated 200,000 tonnes of recycled aggregate for use in construction, using waste which would otherwise be sent to a landfill or exported abroad. The Riverside facility is integral to Cory's vision: that none of London's waste is wasted.

The Riverside facility is predominantly river fed, by a fleet of tugs and barges operating a 'green highway' on the River Thames. By utilising the river, Cory avoids around 100,000 truck movements a year on London's congested roads; reducing air pollution and lowering the carbon footprint of waste treatment, alongside other secondary benefits such as congestion relief, reduced road maintenance and improved road safety.

The 'Cory Riverside Energy: A Carbon Case' report, a study peer-reviewed by the Carbon Trust, concluded that Cory's unique solution has major benefits when compared to landfilling of waste; it saves over 200kg of carbon and produces around nine times the amount of exportable electricity per tonne of waste handled over landfill.[23]

Sending waste to the Cory Riverside EfW has diverted nearly 4 million tonnes of London's waste from landfill since the plant was commissioned in 2011.

Source: Cory Energy

23 Cory Energy, *Cory Riverside Energy: A Carbon Case* (2017)

7.
Clean, green technology

The memory of the polluting incinerators of the 1960s still haunts the public perception of EfW, but it couldn't be further from reality today.

Since the introduction of the Municipal Waste Incineration Directive of 1989, EfW plants have had to comply with strict regulations including emissions limits. These have since been tightened by the Environmental Protection Act 1990 whilst the updated Waste Incineration Directive 2000 was subsequently replaced by the Industrial Emissions Directive (IED) 2010. Under the IED, the Best Available Techniques (BAT) and Emission Limit Values (ELVs) for EfW are set out in the Waste Incineration BAT Reference document (WI BREF), which is periodically reviewed. A rigorous clean-up stage which removes nitrogen oxides, dioxins, acid gases and particulates has been for many years an essential part of the EfW process.

> **Modern, well managed incinerators make only a small contribution to local concentrations of air pollutants. It is possible that such small additions could have an impact on health but such effects, if they exist, are likely to be very small and not detectable.**
>
> *Public Health England, formerly Health Protection Agency, 2013* [24]

> **Modern EfW plants meet very strict environmental standards and perceptions of them as 'dirty' need to be robustly and forcefully challenged.**
>
> *Institution of Mechanical Engineers* [25]

In 2015, EfW produced 0.71% of the UK's NOx emissions, compared to 31.7% emitted by vehicle exhausts. [26]

Dioxins emitted from EfW have reduced by 99% since 1990. Indeed, bonfire night in 2015 produced 10 times more dioxins than EfW across the whole year. [27]

> **The IEA [International Energy Agency] Bioenergy believes that combustion of MSW [municipal solid waste] is no longer a major contributor to emissions of dioxins in countries where the new EU emissions regulations (or similar) have been enforced.**
>
> *International Energy Agency's Bioenergy Task 36, 2005* [28]

24 http://webarchive.nationalarchives.gov.uk/20140714114201/http://www.hpa.org.uk/Publications ChemicalsPoisons/IPPCAndPositionStatements/CRCEMunicipalWasteIncineration/
25 Institution of Mechanical Engineers, *Energy from Waste: A Wasted Opportunity?* (2008)
26 National Atmospheric Emissions Inventory (NAEI)
27 National Atmospheric Emissions Inventory (NAEI)
28 IEA Bioenergy Task 36, *Reducing Dioxin Emissions to Air from MSW Combustion* (2005)

Fine particulates emitted from the combustion process can pose a public health risk. However, in the case of EfW, levels of particulates are extremely low. Domestic wood burning is a far higher emitter of these particulates.

Particulate matter	EfW % UK total 2015	Domestic wood burning % UK total 2015
PM0.1	0.05	24.71
PM1	0.08	25.9
PM2.5	0.05	32.4
PM10	0.03	23.6

Source: NAEI

> **Overall [...] PM10 exposures related to [EfW] emissions in Great Britain are extremely low [...] especially when compared to annual mean background concentrations.**

Study funded by Public Health England on the exposure of PM10 from modern EfW plants in Great Britain, 2017 [29]

> **Modern emissions control systems are capable of reducing particulate matter in the power station emissions to incredibly low proportions; indeed, many modern power stations actually clean the ambient air as it passes through the power station.**

Institution of Mechanical Engineers [30]

> **The continually growing body of scientific evidence does not support the high level of concern relating to air pollution and health effects [...] The waste industry and the emission standards applied to incineration under legislation such as the Waste Incineration Directive are in many ways far more stringent than many other industries and might be said to be one of the heavily environmentally regulated industries in the UK.**

Enviros Consulting, The environmental and health impacts of EFW, 2007 from modern EfW plants in Great Britain, *2017* [31]

> **Emissions from EfW facilities would not be expected to give rise to any significant effect on health.**

Ricardo AEA, Review of research on the health impacts of EfW, *2012* [32]

29 'Estimating Particulate Exposure from Modern Municipal Waste Incinerators in Great Britain', *Environmental Science & Technology* 2017 51 (13), 7511-7519

30 Institution of Mechanical Engineers, *Energy from Waste: A Wasted Opportunity?* (2008)

31 Enviros Consulting Limited, *The environmental and health impacts of Energy from Waste, the myths and the truth?* (2007)

32 AEA, *Review of research into health effects of Energy from Waste facilities* (2012)

8.
Sustainable jobs

Workforce

EfW is a sophisticated technology, and as such, requires a highly skilled work force. EfW currently employs over 2,000 people across the UK on a permanent basis, and many more are involved with supply chains and in the construction of the plants.

Case study

Veolia – Learning while you work

At Veolia, which employs 14,000 people across the UK, the opportunity to develop new skills is encouraged and the company supports continuing education whilst in employment as well as a diverse range of apprenticeships with over 300 apprentices on its existing programme.

Scott Francis
Plant Manager for Staffordshire (Four Ashes) and Shropshire (Battlefield) ERF

Scott joined Veolia working as an Assistant Engineer at the Tyseley Energy Recovery Facility (ERF) in 2003 and since then has gained a degree and become a facility manager.

In his role as Assistant Engineer he utilised all of the practical skills and knowledge he had learned through his apprenticeship and was given responsibility to assist in looking after the construction and commission of a new clinical waste incinerator, as well as getting involved in all aspects of plant maintenance from breakdowns to planned outages.

Scott soon progressed to the role of a Maintenance Engineer and recognised the need for continuing education to support his progression within the engineering industry and Veolia. It was at this point he completed a BEng hons in Mechanical Engineering at Birmingham University.

On Scott's return to the Midlands the Staffordshire ERF was halfway through its construction programme. Scott utilised all of his experience and training and was given the responsibility to look after the mobilisation of the contract and managed the plant through commission to handover.

Scott still looks after the Staffordshire plant now. In 2015 Scott was recognised for all of his skills and experience and was given the Battlefield ERF to manage too.

Scott's achievements are unquestionable and as a former Level 2 Apprentice himself he still recognises the importance of apprenticeships and gets very involved in the apprentices that work for him in his plants. However, Scott goes further than that. It was this passion for apprenticeships that allowed him to really plan and drive an induction week along with other colleagues in the business for 10 young engineering apprentices.

Scott's empathy with the apprentices ensured the apprentices were not only supported on their first week in the business, but also that they had a role model to aspire to.

Scott Francis. Source: Veolia

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